

In the Claims

Applicant submits a new complete claim set showing marked up claims with insertions indicated by underlining and deletions indicated by strikeouts and/or double bracketing.

Applicant respectfully requests that the claim set be amended as shown below.

This listing of claims will replace all prior versions, and listings, of claims in the application:

LISTING OF CLAIMS:

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1. (Original) A monolithic photodetector including a photodiode, a precharge MOS transistor, a control MOS transistor, and a read MOS transistor, the photodiode and the precharge transistor being formed in a same substrate of a first conductivity type, wherein the photodiode includes a first region of a second conductivity type formed under a second region of the first conductivity type more heavily doped than the substrate, and under a third region of the second conductivity type, more heavily doped than the first region, the second and third regions being separate, the first region forming a source region of the second conductivity type of the precharge MOS transistor, the second and third regions being connected, respectively, to a fixed voltage and to a gate of the control transistor.

2. (Original) The photodetector of claim 1, further including a well of the first conductivity type, more heavily doped than said substrate, in which the first region is formed.

3. (Original) The photodetector of claim 1, wherein the first conductivity type is type P and the second conductivity type is type N.

4. (Original) The photodetector of claim 2, wherein the substrate, the well, and the second region are maintained at a low reference voltage of the circuit.

5. (Previously Presented) The photodetector of claim 1, wherein the third region is spaced from a channel region of the precharge transistor.

6. (Previously Presented) The photodetector of claim 1, wherein a cathode of the

photodiode includes the first region.

7. (Previously Presented) The photodetector of claim 1, wherein the photodiode is a fully-depleted-channel type of photodiode.

8. (Previously Presented) The photodetector of claim 1, wherein the third region is operable to maintain a stable quiescent voltage during operation of the photodetector.

B' 9. (Currently Amended) The photodetector of claim 1, wherein the first region is operable to maintain a same ~~the~~ stable quiescent voltage during operation of the photodetector as the third region.

10. (Previously Presented) The photodetector of claim 1, wherein the first conductivity type is N-type and the second conductivity type is P-type.

11. (Previously Presented) The photodetector of claim 2, wherein the well and the first region form a junction of the photodiode.

12. (Cancelled)

13. (Currently Amended) ~~The apparatus of claim 12,~~ An apparatus, comprising:
a substrate of a first conductivity type;
a transistor including a channel region of the first conductivity type and a first region of a
second conductivity type disposed over the substrate, the first region serving as a source region
of the transistor; and
a photodiode including the first region, a second region of the first conductivity disposed
over the first region and a third region of the second conductivity type disposed over the first
region and spaced from the channel region,

wherein the substrate and the second region are connected to a low reference voltage of the apparatus.

14. (Currently Amended) The apparatus of claim ~~13~~¹², wherein the transistor is a precharge transistor.

15. (Currently Amended) The apparatus of claim 14, wherein the precharge transistor is a ~~CMOS~~ MOS transistor.

16. (Currently Amended) ~~The apparatus of claim 14, wherein the apparatus further comprises:~~ An apparatus, comprising:

a substrate of a first conductivity type;

a transistor including a channel region of the first conductivity type and a first region of a second conductivity type disposed over the substrate, the first region serving as a source region of the transistor;

a photodiode including the first region, a second region of the first conductivity disposed over the first region and a third region of the second conductivity type disposed over the first region and spaced from the channel region;

a control transistor having a gate connected to the third region, a first terminal connected to a supply voltage and a second terminal; and

a read transistor having a gate connected to an input signal, a third terminal connected to the second terminal, and a fourth terminal connected to processing circuitry,

wherein the transistor is a precharge transistor.

17. (Currently Amended) The apparatus of claim 16, wherein each of the read transistor, control transistor and the precharge transistor is a ~~CMOS~~ MOS transistor.

18. (Previously Presented) The apparatus of claim 16, further comprising:
a metallization over the third region that connects the third region to the gate of the control transistor.

19. (Currently Amended) The apparatus of claim ~~13~~¹², wherein the third region is spaced from the second region.

20. (Currently Amended) The apparatus of claim 1312, wherein the second region is more heavily doped than the substrate.

21. (Currently Amended) The apparatus of claim 1312, wherein the third region is more heavily doped than the first region.

22. (Currently Amended) The apparatus of claim 1312, further comprising:
a well of the first conductivity type, in which the first region is formed.

23. (Previously Presented) The apparatus of claim 22, wherein a junction of the well and the first region forms a junction of the photodiode.

24. (Previously Presented) The apparatus of claim 22, wherein the well is more heavily doped than the substrate.

25. (Currently Amended) ~~The apparatus of claim 24,~~ An apparatus, comprising:
a substrate of a first conductivity type;
a transistor including a channel region of the first conductivity type and a first region of a
second conductivity type disposed over the substrate, the first region serving as a source region
of the transistor;
a photodiode including the first region, a second region of the first conductivity disposed
over the first region and a third region of the second conductivity type disposed over the first
region and spaced from the channel region; and
a well of the first conductivity type, in which the first region is formed,
wherein the well is more heavily doped than the substrate, and
wherein the second region is more heavily doped than the well.

26. (Currently Amended) The apparatus of claim 1312, wherein a junction of the first region and the substrate forms a junction of the photodiode.

27. (Currently Amended) The apparatus of claim 1312, wherein the photodiode is a

fully-depleted-channel type of photodiode.

28. (Currently Amended) The apparatus of claim 1312, wherein the third region is operable to maintain a stable quiescent voltage during operation of the apparatus.

29. (Previously Presented) The apparatus of claim 28, wherein the first region is operable to maintain a same stable quiescent voltage during operation of the apparatus as the third region.

30. (Currently Amended) The apparatus of claim 1312, wherein the first conductivity type is N-type and the second conductivity type is P-type.

31. (Currently Amended) The apparatus of claim 1312, wherein the first conductivity type is P-type and the second conductivity type is N-type.

32. (Currently Amended) A method of operating a photodetector including a photodiode of a fully-depleted-channel type and a precharge transistor having a source region that serves as a cathode of the photodiode, the method comprising:

accumulating photogenerated charges within the photodiode; and
outputting from the photodiode ~~to a processing circuit~~ a first linear signal representing
~~corresponding to~~ the accumulated photogenerated charges.

33. (Currently Amended) The method of claim 32, wherein the step of outputting includes:

[outputting from the photodiode a second linear signal representing the accumulated photogenerated charges; and]

generating [the first] a second linear signal from the first ~~second~~ linear signal; and
outputting the second linear signal to a processing circuit.

34. (Previously Presented) An apparatus, comprising:
a photodiode of fully-depleted-channel type operable to accumulate photogenerated

charges;

a precharge transistor having a source region serving as a cathode of the photodiode; and
means for outputting from the photodiode a linear control signal representing the
photogenerated charges.

35. (Previously Presented) The apparatus of claim 34, further comprising:
read circuitry operable to receive the linear control signal from the photodiode and to
generate a linear output signal from the linear control signal for input to a processing circuit.
